

Highly Flexible, Fire Resistant HybridSil Foams for Next Generation Fireproofing, Insulation, and Energy Absorption

NASA Applications Project

SBIR/STTR Programs | Space Technology Mission Directorate (STMD)



ABSTRACT

The objective of this Phase I STTR program is to adapt NanoSonic's HybridSil™ nanocomposite technology for the creation of next generation highly flexible, fire resistant foams capable of extended operational lifetimes within demanding aerospace platforms. Phase I optimized nanocomposite foams would have immediate utility within a broad spectrum NASA applications as non-halogenated fire proofing, insulative, de-icing, and energy absorptive materials with tailorable breathabilities.

ANTICIPATED BENEFITS

To NASA funded missions:

NanoSonic's Phase I optimized HybridSil™ insulative coatings will serve as a replacement for currently employed polyurethane and polyimide foams yet provide enhanced fire retardancy, elastomeric flexibility, insulation, impact dissipation, acoustic attenuation, and ice mitigation for a broad range of NASA vehicle, ground, and umbilical support platforms. Additional NASA specific applications include protective clothing and electronic insulation applications. The proposed polyimide HybridSil™ nanocomposite foams will be an extension of NanoSonic's tailorable, high performance HybridSil™ polymer nanocomposite technology which has recently received the R&D 100 Award. Of particular importance to fire resistance and flexibility, the base copolymer technology has independently validated fire and blast protective properties and is currently transitioning to pilot scale manufacturing through a U.S. Navy Commercialization Pilot Program. Thus, the manufacturing infrastructure necessary

To the commercial space industry:

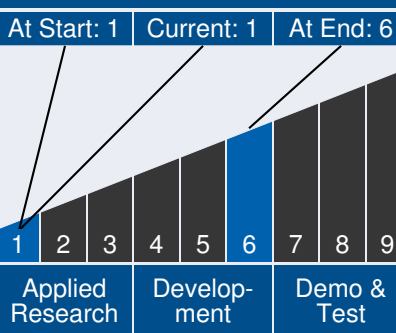
In addition to meeting the solicitation specified cryogenic insulation, fireproofing, energy absorption, ice mitigation, and



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Technology Maturity



Management Team

Program Managers:

- Gary Jahns
- Richard Leshner

Principal Investigator:

- Vince Barnauskas

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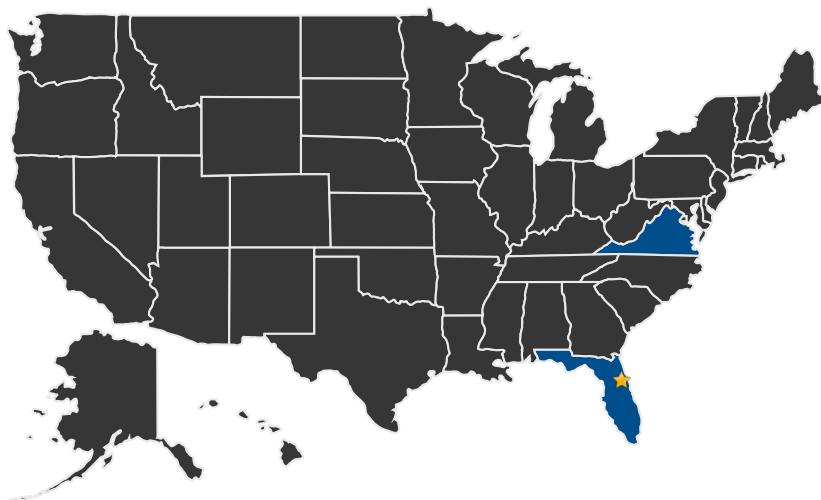


acoustic attenuation applications for NASA vehicle, ground, and umbilical systems, the proposed polyimide HybridSil™ nanocomposite foams will have broad utility within additional defense and commercial applications. Most immediately, NanoSonic's non-halogenated fire resistant foams may be used to provide next generation thermal insulation and energy efficiency within commercial and residential buildings. Specifically, the proposed nanocomposite foam technology will serve as a replacement for currently employed polyurethane foams yet provide orders of magnitude greater thermal insulation, environmentally friendly VOC-free spray deposition processes, validated non-halogenated flame protection, negligible smoke toxicity, and superior mechanical durability. Additionally, insulation systems around high temperature automotive and aerospace structures wou

Technology Areas

Materials, Structures, Mechanical
Systems & Manufacturing (TA 12)
└ Materials (TA 12.1)

U.S. LOCATIONS WORKING ON THIS PROJECT



■ U.S. States
With Work

★ **Lead Center:**
Kennedy Space Center

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Other Organizations Performing Work:

- Nanosonic, Inc. (Pembroke, VA)

PROJECT LIBRARY

Presentations

- Final Summary Chart
 - (<http://techport.nasa.gov:80/file/14212>)

DETAILS FOR TECHNOLOGY 1

Technology Title

Highly Flexible, Fire Resistant HybridSil Foams for Next Generation Fireproofing, Insulation, and Energy Absorption NASA Applications

Technology Description

The objective of this Phase I STTR program is to adapt NanoSonic's HybridSil™ nanocomposite technology for the creation of next generation highly flexible, fire resistant foams capable of extended operational lifetimes within demanding aerospace platforms. Phase I optimized nanocomposite foams would have immediate utility within a broad spectrum NASA applications as non-halogenated fire proofing, insulative, de-icing, and energy absorptive materials with tailorable breathabilities. To that end, NanoSonic and Dr. James McGrath's research group of Virginia Tech will work to design, optimize, and scale-up a family of highly flexible polyimide-polyorganosiloxane HybridSil™ foams with statistically optimized cell content, mechanical durability, thermooxidative resilience, gas permeability, flexibility, and flame retardancy. This program will build from established non-halogenated, high temperature HybridSil™ technology that has passed the ISO 9705 room corner burn test to obtain qualification as "fire restricting" per the International Maritime Organization, demonstrated a flame spread rating of zero (ASTM E-84), yielded thermal conductivities below commercially available polyurethane foams ($< 50 \text{ mW/mK}$), and elastomeric resilience (recovery from 1000 % deformation) from ballistic / blast impact threats . Rapid Phase III transition to commercial integration will be facilitated through an established HybridSil™ pilot scale manufacturing infrastructure capable of producing $> 8,000 \text{ lbs. resin / day}$.